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Assessment of pedometer-determined physical activity in Danish adults: the importance of non-ambulatory activities

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Purpose

To estimate mean values in steps/day for a representative sample of Danish adults (15-75 years) using two different conversion methods for non-ambulatory (non-step) activities.

Methods

A simple random sample comprising 229 adults (52% men) from the Danish National Survey of Dietary Habits and Physical Activity 2007-08 wore a pedometer (Yamax SW-200 Tokyo, Japan) and recorded daily steps and non-ambulatory activities for seven consecutive days. Time spent on non-ambulatory activities was converted to step equivalents using 1) a simple conversion method (SCM) adding 200 step equivalents/min, and 2) a more complex conversion method (CCM) adding activity-specific step equivalents/min (assuming that 3 METs equals 100 steps/min) (Table 1). Very similar conversion methods have been suggested by Miller et al. 2006¹. Moreover, data from a Danish pilot study (n=28) were used to adjust for double-counting during cycling. When adding steps for time spent cycling, the mean number of steps recorded during cycling found in the pilot study was subtracted from the additional steps. The addition of >10000 step equivalents/day was truncated to 10000 step equivalents/day to avoid overestimation.

Table 1. The selected non-ambulatory activities, their prevalence in the sample, and the steps/min rate derived from the CCM conversion method (associated MET levels were identified in the Compendium of Physical Activities²)

| Activity | Participants (n=122) | Days | METs | Steps/min |
|---|----------------------|------|------|-----------|
| Cycling, 16-19 km/h | 98 | 306 | 6 | 200 |
| Cycling, 16-19 km/h (adjusted for double-counting) | | | | 160 |
| Cycling, 19-22 km/h | 4 | 9 | 8 | 267 |
| Cycling, 19-22 km/h (adjusted for double-counting) | | | | 227 |
| Cycling stationary, vigorous | 3 | 5 | 10.5 | 350 |
| Cycling stationary, vigorous (adjusted for double-counting) | | | | 310 |
| Weightlifting | 18 | 38 | 6 | 200 |
| Swimming laps | 1 | 2 | 7 | 233 |
| Swimming, leisurely | 4 | 6 | 6 | 200 |
| Swimming / water aerobics | 4 | 4 | 4 | 133 |
| Horseback riding* | 4 | 4 | 4 | 133 |

* Participants were instructed not to wear the pedometer during horseback riding

Results

53% (45% of men, 62% of women) engaged in non-ambulatory activities during the registration period. The most frequently reported non-ambulatory activity was cycling, especially as transportation, which was reported by 39% (men: 31%, women: 48%) with a mean of 125 min/week (men: 107, women: 138 min/week). Our pilot study showed a mean recording of 40 steps/min during cycling. Calculated steps/day after adjusting for double-counting during cycling are shown in Figure 1 for each of the conversion methods.

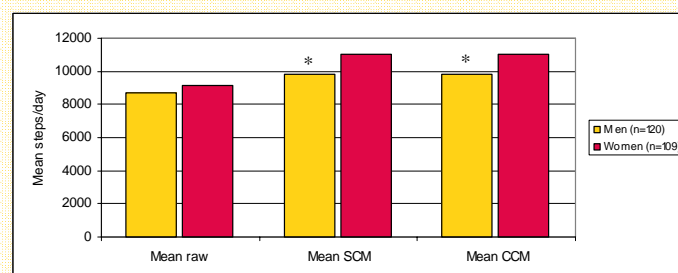


Figure 1. Mean steps/day, raw and calculated using the SCM conversion method, adding 200 step equivalents/min, and the CCM conversion method, adding activity-specific step equivalents/min.

* p<0.05, difference between men and women in mean steps/day

Truncation was carried out for 4-5% of all days for each conversion method. At group level the conversion methods added 1482-1494 step equivalents/day corresponding to a 17% increase. For men 1126-1138 step equivalents/day were added (13-14% increase) vs. 1875-1886 step equivalents/day for women (22% increase), thus significantly higher for women compared to men, p=0.03

Conclusion

In populations like the Danish, where cycling and other non-ambulatory activities are popular, it will be relevant to account for these activities when assessing pedometer-determined physical activity. Adding activity-specific step equivalents/min, or simply adding 200 step equivalents/min, provides very similar results. Furthermore, when accounting for cycling an adjustment for double-counting should be considered.

¹ Miller R, Brown W J, Tudor-Locke C. But what about swimming and cycling? How to count non-ambulatory activity when using pedometers to assess physical activity. JPAH 2006;3:257-266.

² Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, O'Brien WL, Bassett DR Jr, Schmitz KH, Emplaincourt PO, Jacobs DR Jr, Leon AS. Compendium of physical activities: an update of activity codes and MET intensities. Med Sci Sports Exerc. 2000;32:S498-504.

